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25th Anniversary
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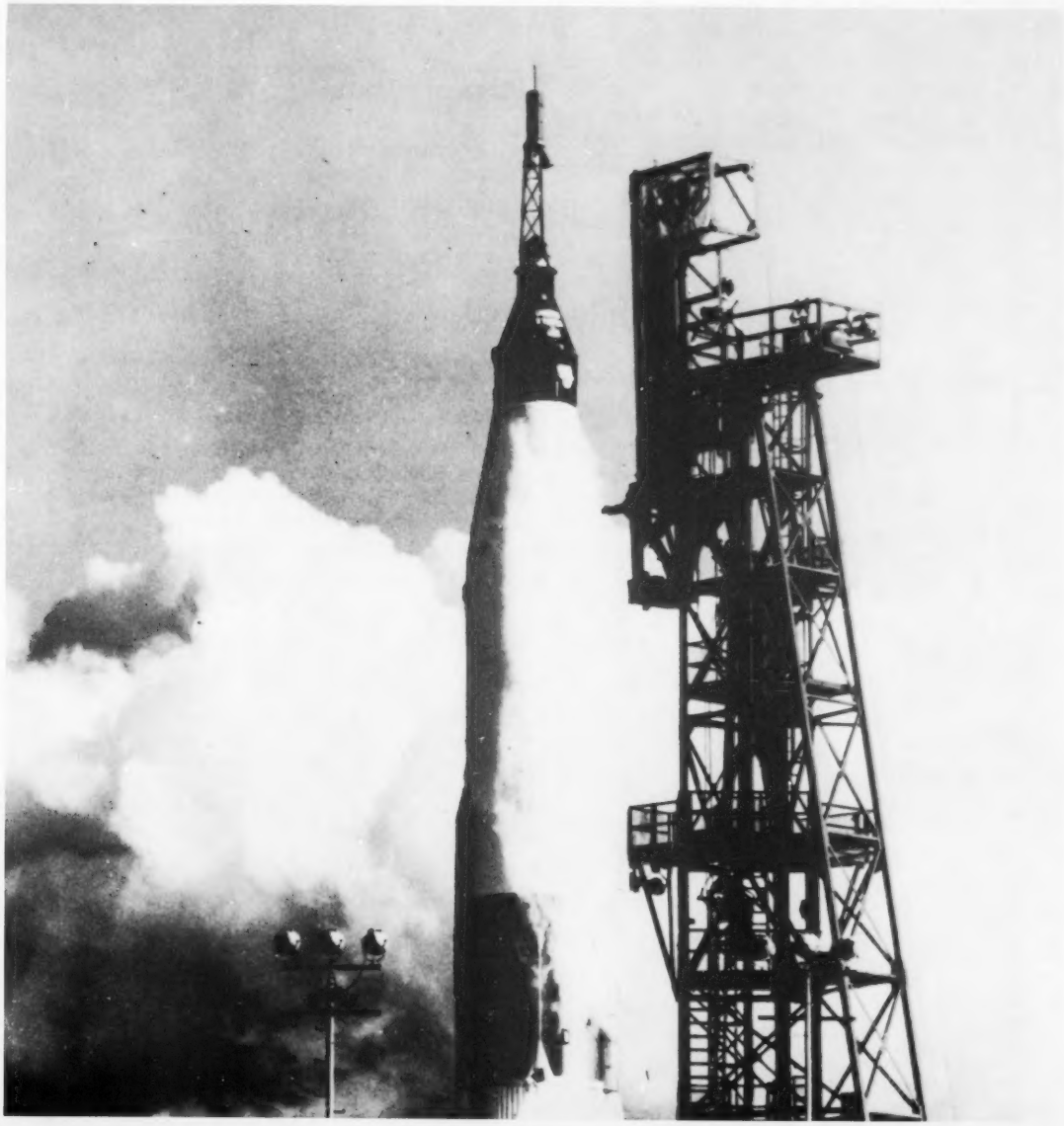

About the Cover

Launch of Mercury Atlas 6 on Feb. 20, 1962, carrying John H. Glenn, Jr., in the Friendship 7 spacecraft. Glenn became the first American to orbit the Earth.

In each of Project Mercury's manned space flights, the assigned astronaut chose a call sign for his spacecraft just before his mission. Glenn selected "Friendship 7." The "7" used in each name stood for NASA's first group of astronauts selected in April 1959: Alan B. Shepard, Jr. (Freedom 7; May 5, 1961); Virgil I. Grissom (Liberty Bell 7; July 21, 1961); John H. Glenn, Jr. (Friendship 7; Feb. 20, 1962); Scott Carpenter (Aurora 7; May 24, 1962); Walter M. Schirra (Sigma 7; Oct. 3, 1962); L. Gordon Cooper (Faith 7; May 15-16, 1963); and Donald K. Slayton. Slayton had been originally scheduled to pilot the Mercury Atlas 7 (Aurora 7) mission but was relieved of this assignment due to a heart condition discovered in August 1959. The mission was subsequently flown by Carpenter. Slayton later flew with the Apollo Soyuz Test Project, July 15-24, 1975.

In Project Mercury, the United States acquired its first experience in conducting manned space missions and its first scientific and engineering knowledge of man in space. After two suborbital (Shepard and Grissom) and three orbital (Glenn, Carpenter and Schirra) missions, Project Mercury ended with the United States' first full-day mission (22 orbits) by L. Gordon Cooper, Jr., on May 15-16, 1963.

NASA's 25th Anniversary, Oct. 1, 1983
Historical Calendar for February

Date	Event
2/2/71	Launch of NATO-B
2/3/65	Launch of OSO-II
2/3/66	Launch of ESSA-I (OT-3)
2/5/67	Launch of Lunar Orbiter III
2/5/69	Launch of Intelsat III F-3
2/6/75	Launch of SMS-B (2)
2/8/62	Launch of Tiros IV (Beta 1)
2/9/78	Launch of Fltsatcom-A
2/14/63	Launch of Syncom 1
2/14/80	launch of SMM-A
2/16/61	Launch of Explorer IX
2/16/65	Launch of Pegasus 1
2/17/59	Launch of Vanguard II (Alpha 1)
2/17/65	Launch of Ranger VIII
2/17/73	JSC renamed
2/18/74	Launch of San Marco C-2 (SM-4)
2/18/79	Launch of SAGE
2/19/76	Launch of Marisat-A (1)
2/20/62	Launch of Mercury (MA-6) (J. Glenn)
2/20/75	Launch of Intelsat IV (F-6)
2/21/61	Launch of Mercury (MA-2) C Little Joe 5A)
2/21/81	Launch of Comstar D
2/24/61	Launch of Explorer (S-45)
2/24/69	Launch of Mariner VI (F)
2/26/66	Launch of Apollo Saturn (SA-201)
2/26/69	Launch of ESSA IX
2/26/82	Launch of Westar IV
2/28/66	Launch of ESSA II (OT-2)

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Fifth Crewmember Added to Shuttle Flights 7 and 8

Dr. Norman Thagard and Dr. William Thornton have been added to the crews of Shuttle flights 7 and 8, respectively. Thagard and Thornton, both physicians, have been added to assist in accomplishment of additional mission objectives. Neither has flown in space before.

Both Thagard and Thornton, mission specialists, will conduct medical tests to collect additional data on several physiological changes that are associated with the space adaptation syndrome. These tests will focus on the neurological system and are a continuation of the new approach to making inflight measurements which began on Shuttle flight 4 last June.

Thagard will join Shuttle mission 7 commander Robert L. Crippen, pilot Frederick H. Hauck, and mission specialists John M. Fabian and Dr. Sally K. Ride. The six-day mission is scheduled for launch in April 1983.

Thornton will join Shuttle mission 8 commander Richard Truly, pilot Daniel Brandenstein, and mission specialists Dale Gardner and Guion Bluford, Jr., for the four-day mission to be launched in July 1983.

Norman Thagard

William Thornton

Boy Scout Project Ready to Aid Space Shuttle Landing During Flight 5

Dodging snakes and snapping alligators in flooded Florida swampland is probably not how most teenagers would envision spending their weekends, but a group of Florida boy scouts worked without pay in those conditions in a challenging project designed to serve America's space program. Over the course of two weekends prior to liftoff of Space Shuttle Columbia on Nov. 11, eagle scout Ed Johnson led seven other scouts

With their feet sunk down in deep mud, members of a Cape Canaveral boy scout troop tie down foam sheets designed as aim points for Space Shuttle Columbia's flight 5 in the event an emergency landing at Kennedy had been necessary during a return-to-launch site abort. From right to left are scoutmaster John Johnson, Ed Johnson, Scott Guisbert and David Pearson.

through flooded semi-tropical swampland to complete the "critical aim point project,"—designed to safely guide NASA's Space Shuttle back to its home port at Kennedy Space Center if a return-to-launch-site abort had occurred.

The scouts positioned 32 sheets of 3-inch thick polyurethane foam, each measuring 1.2 meters by 2.4 meters (4 feet by 8 feet), over wild terrain past the northern and southern ends of the 4.8 km-long (3-mile-long) Shuttle Landing Facility. The squares have been transformed into two diamond-shaped aim points, each measuring 9.8 m × 9.8 m (32 ft. by 32 ft.).

Aim points are an essential part of an emergency landing. One-half minute before touchdown during a return-to-launch site abort, the Space Shuttle would approach the runway at a steep 19 degree angle, nearly seven times as steep as the 3 degree approach for commercial jetliners, and would land at a brisk 215 mph. The aim points, located 2,286 meters (7,500 feet) from the ends of the runway, would enable NASA astronauts to locate the landing strip from altitudes of up to 20,000 feet in good visibility.

Although high-flying astronauts would be able to see the aim points from great distances, the scouts had some initial trouble closer to Earth. "Our biggest problem was locating the site," commented the scoutmaster. "The grass was so high that we couldn't find it, and the water was up to here (holding his hand up to his chin) in some places." One scout, who had fallen into one of the

"holes" where the water level reached up to his neck, nooded his agreement.

The soggy group received some help in transporting all those sheets to the remote area inside the 570 sq. km (220 sq. mi.) Merritt Island Wildlife Refuge. Because of the limited access to the area, a NASA helicopter was used to lift the sheets from the runway ramp and deposit them at the rain-swollen site. The rest of the work was handled completely by the scouts.

With only a radio with which to contact the outside world, the scouts battled the elements. The prime purpose of the project was hailed not as physical work, but to teach the scouts how to establish contact with political, governmental and administrative officials.

But despite the emphasis on the non-physical aspects of the project, hard work in extreme environmental conditions abounded. The soggy southern aim point lies in the marshes adjacent to Banana Creek, an arm of the Indian River running alongside the Atlantic Ocean. The subtropical area teems with alligators, water moccassins, wild hogs and biting squadrons of mosquitos. The scouts also were warned by Federal Fish and Wildlife officials of the dangers of ticks, which transmit Rocky Mountain Spotted fever, and of other wild animals in the refuge.

"We informed them that there was little danger from wildlife," said Dorn Whitmore, a wildlife official, "but if anyone should come across an aggressive alligator, to get out of the area."

Drenched by recent rains, the southern point was under three feet of water, which could be reached only by boat. The relatively dry northern aim point, which was completed first had a knee-high water level, accessible through thick mud. This wildly primitive location was described by one scout as a "big outhouse for birds."

The idea to enlist the scouts to aid NASA with the critical aim point project came from Sam Beddingfield, a Kennedy Space Center official, active in the boy scouts Canaveral district. "In order to become an Eagle Scout, a candidate must demonstrate leadership in outdoors working conditions and gain experience in a position of responsibility," explained Beddingfield.

Although NASA supplied most of the construction material and transportation, eagle scout Johnson did spend $13 on plastic piping. Now that the critical aim point project has been completed, the troop faces a scout board of review to determine whether they have satisfactorily fulfilled the requirements to advance in rank.

Unconventional Wing Design—Artist concept of the X-29A Forward Swept Wing research aircraft, the first X series aircraft to be tested at NASA's Dryden Flight Research Facility, Edwards, Calif., since the X-24B lifting body. Wind tunnel testing of the X-29A models indicate the unconventional wing design should give the aircraft greater maneuverability at transonic speeds and superior low-speed flying qualities, short take-off and landing characteristics and increased range. This model's wing design will be supercritical (designed for low drag) and will be aeroelastically tailored to avoid structural divergence encountered in other forward swept wing models.

Lewis Project Spurs Solid State Electronics

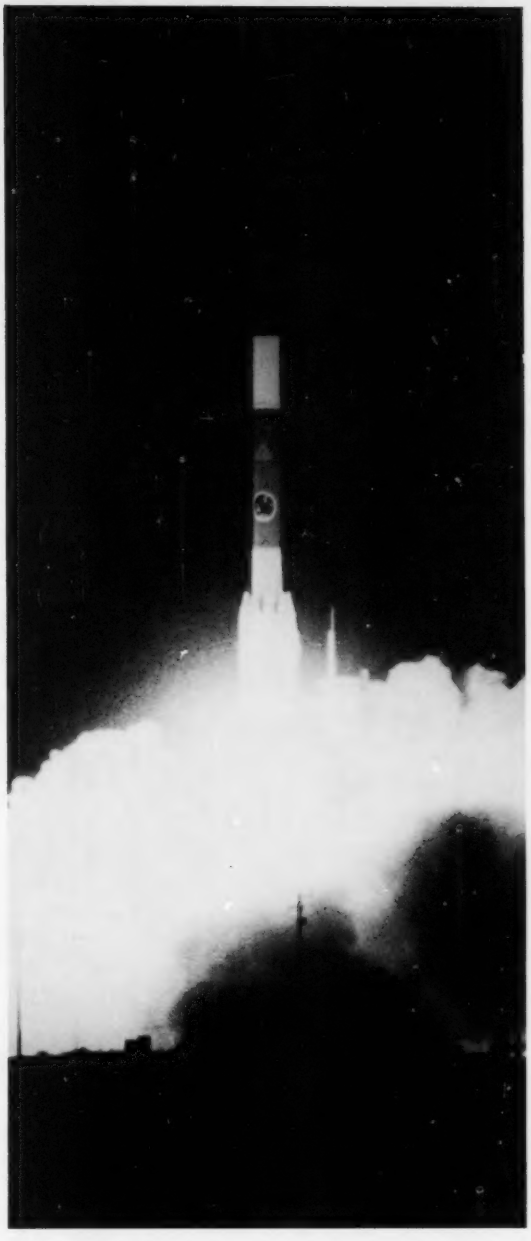
Just as the invention of the transistor ushered in the age of electronics and miniaturization, so the development of new power switching transistors and diodes is leading to a modest revolution in solid-state power electronics. A major contributor to this latter revolution is NASA's Lewis Research Center which has spearheaded creation of a new generation of high-performance transistors and diodes that provide more power at higher voltages in smaller, less expensive packages.

"Our program, now in its ninth year, has led to an assortment of solid-state power devices capable of switching 50 kw of power and more at system voltages in the range of 300 to 1200 volts without sacrificing switching speed, efficiency and ease of control," says Lewis project manager Gale R. Sundberg. Most transistors today limit power levels to less than 5 kw at voltage ranges up to 300 volts.

Value to the space program of such technology is significant. But consumer products, tools for medical diagnosis and treatment, military hardware and industrial operations may also be expected to benefit from these developments, Sundberg believes. "To illustrate," he said, high-power transistors, used for inverters, regulators and power controllers for motors and other loads, could produce savings of a billion dollars per year or more in electric power costs. Typical applications would be induction heaters, programmable controllers, very low frequency transmitters, amplifiers and ac motor drives."

The new power transistors have superior power switching characteristics that significantly broaden the spectrum of transistor application. Functioning primarily as solid-state switching devices for controlling high power, they result in direct reductions in the size, weight and number of components needed in various electrical circuits. Additionally, the use of these transistors can bring about the replacement of cumbersome hydraulic actuator systems with lightweight, efficient motor-driven actuators. This will be possible in industrial as well as aerospace applications.

The main gain for the aerospace program, however, is that the new transistors now make possible future high powered missions such as the advanced Space Shuttle, large space platforms and the all-electric airplane. The higher voltages (270 to 1000 volts dc and 440 volts ac) and higher switching frequencies of 20 to 50 kilohertz at power levels approaching 100 kilowatts



January Launch—The International Infrared Astronomical Satellite (IRAS) lifts off Jan. 25 aboard a Delta 3910 launch vehicle at 6:19 p.m. PST, from Vandenberg Air Force Base, Calif. IRAS will conduct a survey of the entire sky in the infrared region of the spectrum and is expected to provide data on the energy budget of the universe and on the birth and death of stars.

with these transistors will be key factors in the new programs.

Lewis is also upgrading diode technology in accelerating semiconductor improvement. Diodes used in electrical circuits to protect transistors and other circuit components from power surges and to reduce electrical stress during turn-on and turn-off also serve to reduce the size and number of other components needed in the circuit.

Key advantage of the fast recovery, high voltage power diode is its ability to recover high-voltage blocking capability within 400 nanoseconds (400 billionths of a second) when switched from full rated current. It can handle peak reverse voltage of 900 to 1200 volts at 50 amps and peak surge currents of 1000 amps.

Three models (D60T, D62T, D7ST) of the high power switching transistor are now being made and marketed by Westinghouse Electric Corporation. Power Transistor Company of Torrance, California, makes four models (PTC 900, 901, 902 and 903) of the power diode.

Terrell Named to NASA Policy Post

Norman Terrell has been appointed to the newly established position of Associate Administrator for Policy at NASA. Terrell will serve as a policy advisor to NASA Administrator James M. Beggs and Deputy Administrator Hans Mark and will participate in the continuing NASA involvement in the activities of the National Security Council Senior Interagency Group on Space.

Terrell was Director of International Affairs at NASA in 1978 and was Deputy Assistant Secretary of State for Science and Technology from 1978 to 1981. He returns to NASA from the Arms Control and Disarmament Agency where he was Assistant Director for the Nuclear and Weapons Control Bureau.

You've Come a Long Way NASA!—A far cry from NASA's Shuttle space suits, now retired after successful completion of the four orbital flight tests last July, is this 1928 high altitude flight suit. The pilot is posing in front of a Wright Apache aircraft.

Australia to Fly Payload Specialist on Shuttle

Australian Acting Prime Minister, J. D. Anthony, has announced plans to fly an Australian payload specialist on the Space Shuttle. The Australian payload specialist will fly on one of two 1985 Space Shuttle flights on which space has been reserved for launch of communications satellites by AUSSAT Pty., Ltd., operator of Australia's national satellite system.

Australia's announcement came in response to an offer made recently by NASA Administrator James M. Beggs. The offer was based on NASA's newly enhanced policy which expands opportunities for sponsors of payloads on the Space Shuttle to fly their own personnel. Australia is the first country to formally announce the intention to take advantage of this opportunity.

Under the revised policy, major payload sponsors will have the opportunity to nominate specialists to accompany their payloads into space on the Shuttle. Training and flight of these payload specialists will normally be on a reimbursable basis, although other arrangements may be negotiated in the case of cooperative flight projects involving the Space Shuttle.

The Australian Department of Science and Technology will be responsible for the selection of the astronauts and other arrangements, in association with AUSSAT. The department is also responsible for the operation of Australian telecommunications systems using satellites.

The two Australian satellites will be used for direct television broadcast, voice, data and public telephone services to continental Australia and off-shore territories. The satellites will be built by the Hughes Aircraft Co., Los Angeles, Calif.

Lewis Completes Reimbursable Project on Jet Fuel Savings

NASA's Lewis Research Center, Cleveland, has completed a five-year, $39-million engine component improvement program designed to produce near-term fuel savings for commercial jet-powered aircraft. An unusual feature of the now-concluded project is that much of NASA's cost is to be repaid by contractors Pratt & Whitney and General Electric.

The work focused both on improving performance of current engines and finding causes of engine performance deterioration that occur after the airplane goes into commercial service.

Two significant gains reported from the reduced deterioration portion of the program are:

- Identification of engine areas in which cost-effective refurbishment is possible beyond what already is being done.
- An understanding of where and why performance losses occur in jet engines.

The specific goal of the program was to provide the potential for reducing overall fuel usage by up to 5 percent for most currently flying jet engines.

Using results of the program, KLM Royal Dutch Airlines and Swiss Air have reported an improvement of 1 percent thus far in cruise-specific fuel consumption due solely to cold section refurbishment. Even that relatively minor change translates, on a single high-bypass engine, into a fuel savings of 30,000 gallons of fuel per year.

"As expected, some of the results of this program also will find their way into designs of totally new engines of the future," said Lewis' John E. McAulay, who managed the Engine Components Improvement Office at Lewis.

Under the reimbursement feature of the program, contractor repayments to NASA over a 10-year period are to be based on sales of improved components resulting from the program to engine users, both as replacement parts in older engines and in newly manufactured engines. So far, NASA has recovered nearly $1 million from the contractors, with a total of $19-20 million potentially recoverable.

Lewis has two other major research projects underway also aimed at improving the fuel economy of America's commercial aircraft. One is the Energy Efficient Engine (E^3) program, aimed at developing fundamental design changes for future turbofan aircraft engines. The other is the Advanced Turboprop program, which seeks to develop a high-speed turboprop propulsion system that will power an aircraft at or near jet speeds and altitudes on 30 to 40 percent less fuel than currently flying jet engines.

Aeronautics research is a focus of work done at several NASA facilities: Lewis Research Center, Cleveland; Langley Research Center, Hampton, Va.; Ames Research Center, Moffett Field, Calif.; and Dryden Flight Research Facility, Edwards, Calif. Lewis is NASA's lead center for aeronautical propulsion research. Airframe technology is the major aeronautical activity at Langley. Flight testing of advanced aeronautical concepts is a principal activity of Ames and Dryden.

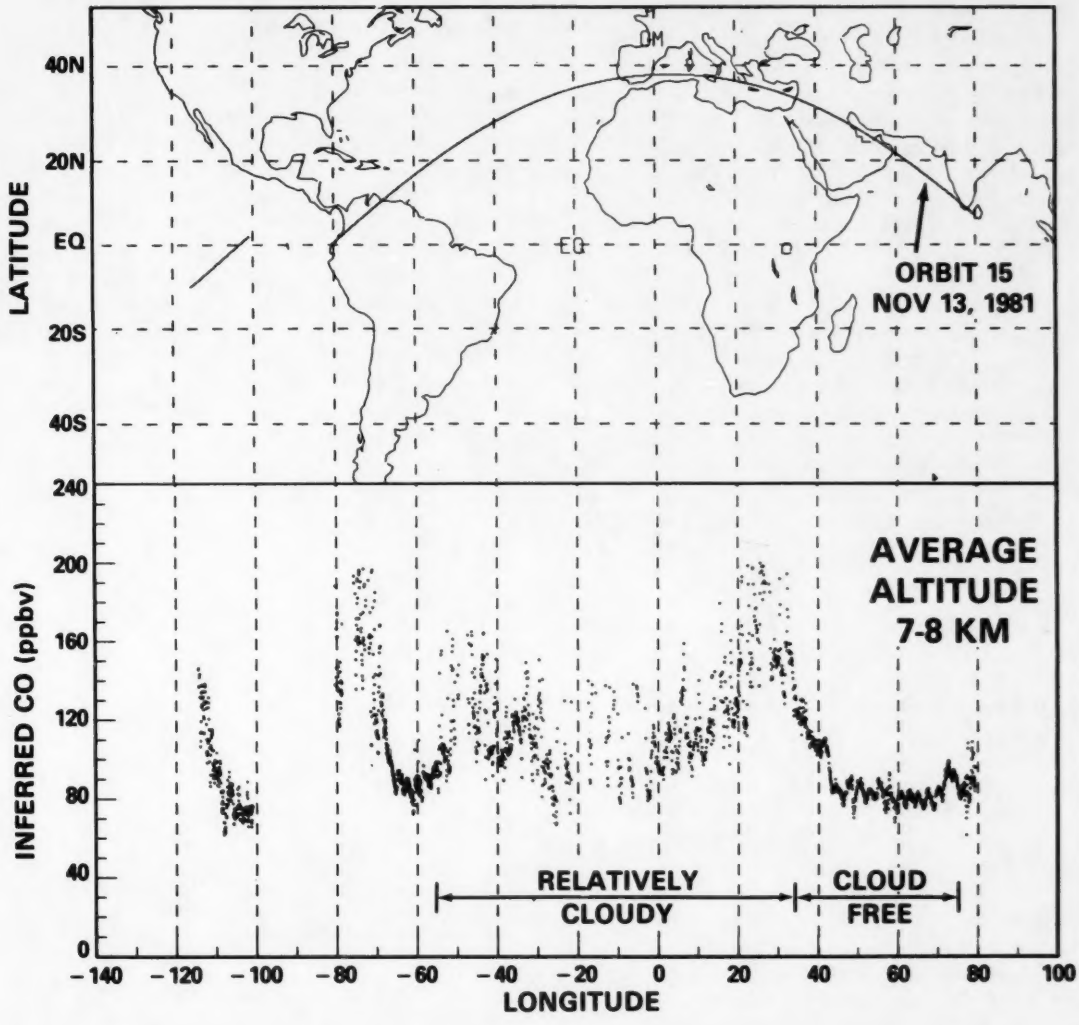
Earth's Pollutants Mapped from Shuttle Experiment Data

An Earth-orbiting experiment flown on the Space Shuttle can provide scientists with data to map accurately changes within the Earth's atmosphere. The experiment, Measurement of Air Pollution from Satellites (MAPS), charted concentrations of carbon monoxide gas around the world over a range of latitudes extending from 30 degrees south to 38 degrees north during the second Space Shuttle flight. The performance of MAPS on this flight proved the system to be a faster, more efficient method of mapping trace gases in the Earth's atmosphere than chromatograph devices.

MAPS used a gas filter radiometer to obtain measurements of the carbon monoxide mixing ratio in the middle troposphere and stratosphere. The radiometer method is simpler and much less expensive than previous gas chromatograph devices. The experiment produced concentration maps of carbon monoxide.

Early analysis of MAPS data concentrated upon measurements performed during orbital pass 15 on Nov. 13, 1981. This orbital pass of the Shuttle began over

High Performance Booster Testing—High performance development motor for the Space Shuttle solid rocket boosters shown during a test firing in the Utah desert. The motor, developed and tested by the Wasatch Division of Thiokol Corp., under contract to NASA's Marshall Space Flight Center, Huntsville, Ala., has been redesigned to increase the initial thrust of the Shuttle boosters at liftoff to provide the spacecraft with an increased payload carrying capability. The higher performance motors will provide an additional four percent thrust capability over the motors currently in use which deliver about 2.8 million pounds of thrust at liftoff. The higher thrust motors will be used for the first time during Shuttle flight 8, now scheduled for mid-1983. Two of the giant solid rocket boosters, of which the motor is the major component, provide approximately 75 percent bulk of the Shuttle's power for liftoff from the launch pad and during the first two minutes of flight.



Bottom graph displays typical gradients in carbon monoxide concentration observed by the Space Shuttle experiment, Measurement of Air Pollution from Satellites (MAPS), during the second flight of the Space Shuttle in Nov. 1981. This experiment obtained the first orbital measurements of carbon monoxide abundance in the Earth's atmosphere. Data collected from MAPS, collected between 38 degrees north and 38 degrees south latitude will be used to produce the first global map of carbon monoxide abundance in the middle troposphere and lower stratosphere that has ever existed. The top graph indicates the principal area of MAPS data collection during orbit 15.

central America, continued east over the Mediterranean Sea, turned southeast over the Persian Gulf, the Arabian Sea and extended to the southern tip of India. The concentration of carbon monoxide within this extended area ranged from 70 parts per billion over the Americas to a high of 115 parts per billion over the eastern Atlantic Ocean and 140 parts per billion in the Mediterranean area. These measurements were performed in less than 20 minutes from the vantage point of the Shuttle. Similar measurements from aircraft platforms would have required observations over many hours.

Analysis of experiment data so far indicate significant concentrations of middle troposphere carbon monoxide mixing with both north/south and east/west variation over the north Atlantic and the Mediterranean Sea and

the Middle East. Accuracy of the measurements has been determined to be within 15 percent with a repeatability of about 5 percent from orbit to orbit. Carbon monoxide gas is produced by natural processes (e.g. oxidation of methane in wetland areas and forest fires) and man's activities (e.g. slash-and-burn agriculture and automobile emissions). Man's contribution to the global atmospheric budget of carbon monoxide has grown significantly during this century, resulting in a large assymmetry between the carbon monoxide concentration in the northern and southern hemispheres.

The major atmospheric sink for carbon monoxide is a complex sequence of photochemical reactions which oxidize carbon monoxide molecule into carbon dioxide. One of the initial steps in this oxidation process is the combination of carbon monoxide with the hydroxyl ion OH. OH plays a major role in a variety of other atmospheric processes, notably reactions involving sulfur dioxide, nitrous oxides and chlorofluoromethanes.

Carbon monoxide oxidation can potentially divert OH from reactions with these other gaseous species and alter the overall chemical balance within the Earth's atmosphere.

NASA plans to refly MAPS on the 7th Shuttle mission, scheduled for summer 1983, to study seasonal variations in the total abundance and regional distribution of carbon monoxide within the Earth's atmosphere.

Although the second Shuttle flight was abbreviated, the experiment collected data for about 42 hours and the investigators were able to corroborate the sampled areas with the instrument readings taken with under-flying aircraft and with other surface information.

Reduction of MAPS data is continuing at the present time, and MAPS researchers expect to release the first global map of carbon monoxide concentrations at low to mid latitudes by early 1983.

The MAPS instrument was constructed at NASA's Langley Research Center, Hampton, Va. Dr. Henry G. Reiche, Jr., is the principal investigator, with assistance from Langley personnel, in addition to the Old Dominion University, Norfolk, and Systems and Applied Sciences Corp., Hampton.

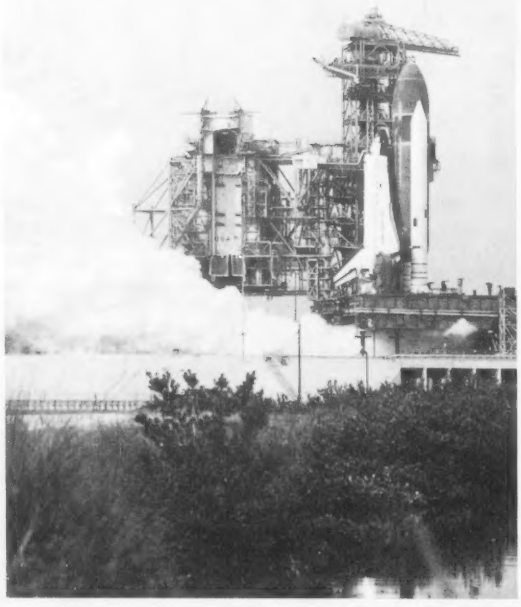
Correction:

In the October 1982 issue of NASA Activities, p. 12, top right column: added to the list of NASA centers participating in the symposium on Non-Urban Troposphere should have been NASA's Jet Propulsion Laboratory. A paper entitled "Temperature Dependence of $HO_2 + NO_2$ Reaction and Its Relevance to Tropospheric Chemistry was presented by Dr. Stanley P. Sander.

Columbia's Engines to be Refurbished for Use on Orbiter Atlantis

With the new Space Shuttle orbiter Challenger to make its maiden flight in March, the orbiter Columbia will be undergoing refurbishment for the next year before its future operational flights. Also receiving an overhaul during this time will be the three Space Shuttle main engines that helped power Columbia to orbit on each of its five flights.

The three engines are scheduled to undergo a complete overhaul before they are reused again on the orbiter Atlantis. These engines, which were operated at 100 percent of rated thrust on Columbia, will be modified and retested to certify them for operation at 109 percent aboard Atlantis. The engines will be removed from Columbia and shipped back to the



Second Firing—Space Shuttle Challenger's engines are test fired on Jan. 25 for another 20-second interval to determine the cause of a hydrogen leak discovered during the first flight readiness firing on Dec. 18.

manufacturer—Rocketdyne Division of Rockwell International in Canoga Park, Calif.—where they will be modified to run at a higher thrust level. After the engines arrive at the plant, the first order of business will be to carefully disassemble them. Then every part will be inspected and tagged to determine wear and reusability. "We know that some parts will have to be replaced because of the increased temperatures and pressures they will see at the higher power level," said Dr. Judson Lovingood, manager of the Space Shuttle Main Engine Project at NASA's Marshall Space Flight Center, Huntsville. "But we would also like to see if the flight environment has a different effect on the hardware that we have seen in ground testing."

The engines will then be reassembled and thoroughly checked before being shipped to Marshall's engine test facility at National Space Technology Laboratories, Miss., where they will undergo a series of acceptance test firings. These firings, tentatively scheduled for the fall of 1984, will include an ignition test, calibration test and endurance test. The engines underwent similar test firings before they were installed in the orbiter Columbia. After the engines have been accepted for flight by Marshall they will be installed in the Atlantis in time for its first mission in 1985.

Columbia, which will be outfitted with three brand new engines, is scheduled to make its next flight in September 1983 carrying Spacelab, a reusable scientific laboratory developed for NASA by the European Space Agency.

ISEE-3 to Explore Earth's Magnetotail and Comets

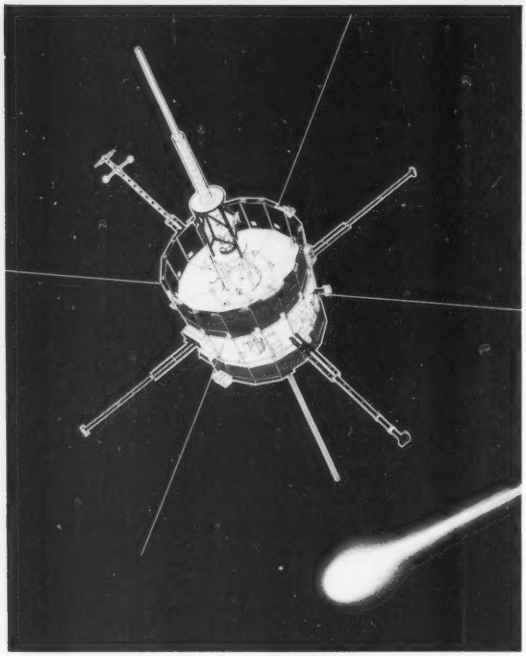
In what may be the most complex set of orbital maneuvers ever undertaken with a NASA spacecraft, a four-year-old satellite is being moved on a series of looping trajectories. It is being moved so it can study the Earth's magnetotail through 1983, fly across the wake of comet Giacobini-Zinner in September 1985, and study the solar wind's effect on Halley's Comet during late 1985 and early 1986.

The satellite, the International Sun-Earth Explorer (ISEE-3) is truly a satellite of firsts:

- first spacecraft to orbit a point in space (in this case, the Sun-Earth libration point);
- first spacecraft to continuously monitor solar-wind conditions upstream from Earth;
- first spacecraft to explore distant geomagnetic tail between 80 and 250 Earth radaii;
- first spacecraft to use multiple swingbys of the Moon for orbital control.
- first spacecraft to intercept a comet.

Flight controllers at NASA's Goddard Space Flight Center, Greenbelt, Md., began moving ISEE-3 on June 10. It is being redirected from a position 1.6 million kilometers (1 million miles) from Earth where it already has been the first satellite to orbit a libration point: that is, a point of balance between the Earth's and Sun's

Tilt Rotor Testing at Sea—Promising candidate for future civil and military applications is the tilt rotor transport which combines the vertical lift, hover and maneuverability advantages of the helicopter with the greater forward speed of the fixed-wing airplane. Bell Helicopter Textron built two experimental XV-15 Tilt Rotor Research Aircraft for a NASA Army program intended to prove the concept and provide design information. The XV-15 has helicopter-like motors for vertical takeoff and landing; once airborne, the rotors tilt forward to become propellers for cruise flight. The XV-15 can fly roughly twice as fast and twice as far as a helicopter on an equal amount of fuel. Shown here, the XV-15 is anchored in place aboard the USS Tripoli by tie-down chains while the engines are started (left photo). The XV-15 executes a vertical takeoff from the flight deck (right photo).



Artist concept of ISEE-3 leaving comet Giacobini-Zinner after flight through the comet's tail.

gravitational pulls. Orbiting about the libration point since its launch in 1978, ISEE-3 has been monitoring the solar wind of charged particles and energy streaming from the Sun toward Earth.

Goddard now will use the satellite's magnetometers and charged-particle monitors to chart the magnetotail of the Earth, produced by the flow of solar wind past the Earth, and compare it with the tail of a comet.

Because the mission will use a spacecraft already in orbit, project directors expect all the observations to cost less than $5 million. Most of this money will upgrade NASA's Deep Space Network to capture ISEE-3's faint signals as the satellite moves as far as 96.6 million km (60 million mi.) from Earth.

According to the mission's chief architect, Robert Farquhar, attempting to duplicate the ISEE observation with new spacecraft could cost as much as $200 million. "We're getting a bargain of science in tight budget days," Farquhar notes.

ISEE-3, which already has outlived its designed lifetime of three years monitoring the Sun, remains in good condition, and carries ample fuel supplies. Relieving it of its duties at the Sun will allow it to be used as a precursor to more detailed mapping of the Sun-Earth neighborhood by NASA later this decade. It will also afford a timely opportunity to expand cometary studies already scheduled for the appearance of Halley's Comet in 1985.

Intercepting the smaller comet Giacobini-Zinner in advance of international probes to Halley's comet not only will permit comparative studies between the two comets to be made, but it also will afford the opportunity to fly through a cometary tail, which the Halley probes will not attempt.

To send ISEE-3 on a trip to three different targets over almost four years and billions of miles, flight engineers must extend ISEE's fuel range by a series of gravity assists from the Moon. The closest of these lunar swingbys will bring ISEE-3 within 100 km (62 mi.) of the moon's surface on Dec. 23, 1983, as the satellite starts away from the Earth on a 20-month journey to the first of its cometary encounters. But the toughest challenge of all will be flying through a comet's tail. Little is known about a comet's environment and, in the case of Giacobini-Zinner, even the comet's exact orbital path remains to be determined.

ISEE-3 Mission Events

Launch	Aug. 12, 1978
Insertion "orbit" around Sun-Earth Libration point	Nov. 20, 1978
Departure from libration point orbit	June 19, 1982
First traverse of Earth's geomagnetic tail	Oct. 19-24, 1982
Extended exploration of distant geomagnetic tail region	1. Jan.-March 1983 2. May-Sept. 1983
First lunar swingby	March 30, 1983
Second lunar swingby	April 24, 1983
Third lunar swingby	Sept. 28, 1983
Fourth lunar swingby	Oct. 22, 1983
Fifth lunar swingby (30 minute lunar shadow) (closest approach—100 km)	Dec. 23, 1983
Lunar-Earth-Moon system	Jan. 1984
First sighting of Comet Giacobini-Zinner by ground-based telescopes	Jan.-Feb. 1985
Retarget ISEE-3 for close encounter with comet	March 1985
Giacobini-Zinner encounter	Sept. 11, 1985
Closest approach to Halley's comet	March 28, 1986
End of mission	March 1987

What's New in NASA's Television and Radio Programming

Each month NASA Headquarters produces news features for television and radio release that carries the NASA message nationwide. For television audiences, stories are produced on ¾-inch video tape; copies are sent simultaneously to all NASA Visitor Information Centers and Public Affairs Offices, and to 650 television stations nationwide as well as to 425 cable television systems via the satellite SATCOM III. NASA Headquarters television producer Joe Headlee develops new material for release each month. Five hundred television stations receive material formatted as a 4½-minute program; the remaining 150 stations receive a 90-second "spot"—a condensed version of the 4½-minute presentation. For December, he produces a special 14½-minute tape called the "Yearender," a wrap-up of NASA's achievements through the year.

NASA's radio programs are sent to over 2,000 radio stations across the nation; in addition, translations of the recordings are made by Voice of America and Radio Free Europe and these tapes are then released to the appropriate audiences overseas. Each month, radio producer Ivelisse Rodriguez prepares one monthly report of 14½ minutes, four 4½-minute weekly stories (one story in the set is featured for one week of the month), and ten 1-minute space notes, released quarterly. Audio news features are produced prior to major events.

Rodriguez describes her monthly programs as "a good look at what's going on where" within NASA and adds that her programs give the listener an inside view of a specific NASA program or project through the words of key people affiliated with the program.

Copies of NASA radio tapes listed in this column are available upon request from your local NASA Public Affairs Office or by phoning Ivelisse Rodriguez at (202) 755-8354, FTS 755-8354; or by mailing your request to her at the following address: NASA Headquarters, Public Affairs Division, Mail Code LFD-8, Room 6102, Washington, D.C. 20546. Rodriguez welcomes your ideas or suggestions for future topics.

Programs Released in January (running through Feb. 4)

Television:

Aeronautics and Space Report—Two-part series (4½ minutes)
Teleoperators (2 min., 37 sec.)
Icing Research (1 min., 15 sec.)

Radio:

25 Years in Space . . . and the Adventure Will Never End (monthly report featuring NASA Administrator James Beggs; 14½ minutes)

Space Highlights . . . 1982 (4½-minute weekly report; featuring James Beggs)

Space Shuttle 6 . . . and the New Tracking Station in Orbit (4½-minute weekly report; featuring James Beggs and Robert Aller)

NASA's Next Major Space Initiatives (4½-minute weekly report; featuring James Beggs)

Space Exploration in the 1980s (4½-minute weekly report; featuring James Beggs)

Space Notes (1 minute each):
Challenger's Maiden Flight
Revolution in Communications
Watching the Birth and Death of Stars
Baffling Discovery by Arecibo Telescope
Shuttle Imaging Radar
Most Distant Object in Universe Discovered
International Sun-Earth Explorer
Satellite Images Reveal New Ocean Features
Detecting Minerals from Space
Spacelab

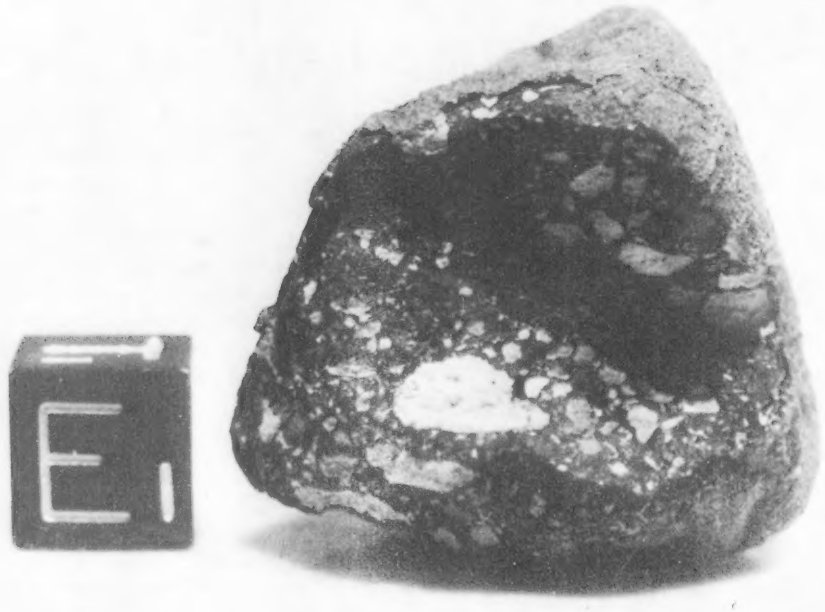
Awards Corner

The **1982 Halpern Award** in photochemistry has been awarded to NASA's **Dr. Joel S. Levine,** a senior research scientist in the Theoretical Studies Branch, Atmospheric Sciences Division, at Langley Research Center, Hampton, Va. Levine, the first federal government employee and the youngest person ever to receive this award, won the nomination over 99 other candidates. He was cited for his accomplishments and leadership in studies of the photochemistry of the Earth's atmosphere and the atmosphere of Mars and Venus. This award is one of 12 in the physical and biological sciences given annually by the New York Academy of Sciences. The Halpern Award, honoring outstanding scientific achievement, has been given each year for the past 165 years.

Nineteen NASA executives have received **1982 Presidential Rank Awards.** The ranks of **Distinguished Executives** and **Meritorious Executives** are awarded to career Senior Executive Service (SES) members who have performed in an exemplary manner over an extended period. In fiscal year 1982, these awards were conferred upon only .6 percent and 2.5

percent, respectively, of the estimated 6,500 federal SES population. The Presidential Rank Awards were created by the Civil Service Reform Act of 1978 and constitute the highest awards that can be given to federal career executives. Each agency annually submits recommendations of nominees to the Office of Personnel Management; they, in turn, confirm their selections with the President who confers the honors. Distinguished Executive awards are granted to those employees who have demonstrated "sustained extraordinary accomplishments"; Meritorious Executive awards are given for "sustained accomplishments." Of the 38 total **Distinguished Executive** awards given for fiscal year 1982, NASA had three recipients: **George Page** (Kennedy Space Center); **Aaron Cohen** (Johnson Space Center); and **Clarence Syvertson** (Ames Research Center). These executives received their awards at a White House ceremony conducted on Nov. 22.

Of the 184 total **Meritorious Executive** awards issued for fiscal year 1982, NASA had 16 recipients: **Andrew J. Stofan** (Lewis); **Philip E. Culbertson** (Headquarters); **J. R. Thompson** (Marshall); **Robert H. Gray** (Kennedy); **Melvin J. Hartmann** (Lewis); **George B. Hardy** (Marshall); **Robert O. Piland** (Johnson); **Alan B. Chambers** (Ames); **William H. Robbins** (Lewis); **David Atlas** (Goddard); **Richard H. Peterson** (Langley); **Lynwood C. Dunseith** (Johnson); **Jesse W. Moore** (Headquarters); **Thomas Campbell** (Headquarters); **Angelo Gustaferro** (Ames); and **Arnold D. Aldrich** (Johnson). These executives received their awards at a State Department ceremony held on Jan. 19.



Fallen Moon Rock?—Photo shows a meteorite found in Antarctica by a research team made up of personnel from NASA, the National Science Foundation and the Smithsonian Institute. The 32-gram sample, black and gray in color with white and gray clasts throughout, has characteristics very similar to rocks brought back from the highlands of the moon on NASA's three Apollo flights. Scientists at NASA's Johnson Space Center are currently studying the meteorite discovered in the Allen Hills region of Antarctica. For studying, a section has been removed from the sample. At left is a ground orientation cube. The "E" designates that this side of the meteorite shown in the photo was facing east when the rock was removed from the ground impact site.

Expendable Launches for 1983

Name	Launch Date	Vehicle	Range	Mission Remarks
*IRAS	January 25	Delta	WSMC	Infrared astronomy. NASA scientific.
Intelsat V-F	March 10	Atlas Centaur	ESMC	Intelsat communications. Reimbursable.
RCA-F	March 31	Delta	ESMC	RCA communications. Reimbursable.
NOAA-E	March	Atlas-F	WSMC	NOAA weather and SARSAT. Reimbursable.
NAVY-21	2d quarter	Scout	WSMC	DOD transit. Reimbursable. Call up.
GOES-F	April 28	Delta	ESMC	NOAA weather. Reimbursable.
Galaxy-A	June 9	Delta	ESMC	Hughes Communications, Inc. Reimbursable.
HILAT	June	Scout	WSMC	Air Force research and development. Reimbursable.
Telstar-3A	July 28	Delta	ESMC	AT & T communications. Reimbursable.
San Marcos D/L	July	Scout	SMR	International cooperative/Italy.
RCA-G	August 25	Delta	ESMC	RCA communications. Reimbursable.
AF-1	August	Scout	WFC	Air Force development program. Reimbursable.
NOAA-D	August	Atlas-F	WSMC	NOAA weather. Reimbursable.
Galaxy-B	September 22	Delta	ESMC	Hughes Communications, Inc. Reimbursable.
NATO-IIID	October 27	Delta	ESMC	NATO communications. Reimbursable.
NAVY-22	4th quarter	Scout	WSMC	DOD transit. Reimbursable. Call up.
Intelsat VA-A	December	Atlas Centaur	ESMC	Intelsat communications. Reimbursable.

* Successful launch

Space Shuttle Launches for 1983

Orbiter	Launch Date	Launch Number	Launch Site	Payload
Challenger (OV-099)	March	6	KSC	TDRS-A
Challenger (OV-099)	April 20	7	KSC	OSTA 2; SPAS-01 Telesat-F; Palapa B-1
Challenger (OV-099)	July 4	8	KSC	INSAT 1-B; TDRS-B
Columbia (OV-102)	September 30	9	KSC	Spacelab 1
Challenger (OV-099)	December 14	10	KSC	DOD 84-1

Patents for Inventions from NASA Research

The Office of General Counsel, NASA Headquarters, announces that the following U.S. patents have been issued by the U.S. Patent and Trademark Office to NASA for inventions resulting from NASA research. Inquiries concerning them should be directed to the attention of the NASA Patent Counsel of the indicated installation.

Inventor(s) & Employers	Title	Patent No.	Installation
Charles W. Galloway, NASA/JSC	Gas to hydraulic	4,360,325	JSC
John C. Evans, Jr., NASA/LeRC	Heat transparent high intensity high efficiency solar cell	4,360,701	LeRC
Cecil W. Campbell and Robert B. Owen, NASA/MSFC	Collimated beam manifold with the number of output beams variable at a given output angle	4,362,361	MSFC
Sheng Y. Lee, NASA/GSFC	Method of neutralizing the corrosive surface of amine-cured epoxy resins	4,362,769	GSFC
Minoo N. Dastoor, Wayne W. Schubert and Gene R. Petersen, Caltech/JPL	Enhancement of in-vitro guayule propagation	4,363,188	JPL
Theodore R. Creel, Jr., and Ivan R. Beckwith, NASA/LaRC	Sound shield	4,363,237	LaRC
Joseph S. Heyman, NASA/LaRC	Pulsed phase locked loop strain monitor	4,363,242	LaRC
Emanuel Tward, Caltech/JPL	Cycling joule thomson refrigerator	4,366,680	JPL
Richard B. Hoover, NASA/MSFC	Extended range X-ray telescope	4,370,750	MSFC

Another Dividend from Air and Space

Research and development in aeronautics and space have provided numerous benefits for all Americans—and at a tiny percentage of the tax dollar. Here is an example:

Water Filter

A booming water filter business was launched by technology first developed to purify water supplied aboard Space Shuttle orbiters. The Shuttle system, developed by Chemtric, Inc., Rosemont, Ill., is a compact, lightweight, electrolytic water sterilizer that generates silver ions in concentrations of 50 to 100 parts per billion in the water flow system.

The silver ions serve as an effective bactericide/deodorizer.

Ray Ward, now president and chairman of the board of Bon Del Manufacturing Co., Mesa, Ariz., received technical information from NASA on the sterilizer and used this data as the basis for his own development—the Bon Del Bacteriostatic Water Filter*.

Ward's business all resulted because he didn't like the taste of the water when he moved from Utah to Arizona in 1977. He decided to develop his own filter; friends and neighbors who learned of Ward's filter wanted one of their own. Their need and the rapid acceptance of his design began a growing business; Don Del water filters now are sold worldwide by some 20,000 distributors.

The Bon Del filter is about the size of a thermos bottle and attaches to a faucet. Tap water passes through a filtering element of silver which has been chemically plated onto activated carbon. The silvers inhibits bacterial growth while the activated carbon removes objectionable tastes and odors caused by the addition of chlorine and other chemicals to the municipal water supply.

Bon Del produces the filter in three models: a kitchen unit (photo at bottom left), the company's best seller; a "Tourister" unit, for portable use while traveling and a refrigerator unit that attaches to the ice cube water line. A filter will treat 5,000 to 10,000 gallons of water.

* NASA does not endorse commercial products as a result of its Technology Utilization or Patent Licensing Programs, but it does encourage the widest possible use of its technology.

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